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THE AMERICAN
GAS LIGHT JOURNAL
REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXXVI. No. 10. Whole No. 550. | NEW YORK, TUESDAY, MAY 16, 1882. | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
G. WARREN DRESSER, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European Countries, $3 50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

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Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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[OFFICIAL NOTICE.]

Third Annual Meeting of the Central Gas Engineers Association.

The Third Annual Meeting of the Central Gas Engineers Association will be held at the Vanderbilt House, Syracuse, New York, on Wednesday, May 17th, 1882. It being the occasion of the election of officers, it is trusted there will be a full attendance of the members. Members are earnestly requested to prepare papers to be read at this meeting, that it may be one of great interest.

C. A. WHITE, *Secretary.* A. C. WOOD, *President.*

GAS ENGINES.

Of all the various uses to which gas can be advantageously applied, outside of illumination, there is no one object to which the inventive genius of our time can be applied with more beneficial results than to gas engines. Up to the present time much has been accomplished by individual effort in securing a perfection of power development much beyond that obtained by the steam engine at a corresponding age.

But one most serious difficulty presents itself to the gas manager in recommending the gas engine to his customers for power purposes, and that is that they are not to be had except at the end of a long delay. Unquestionably the Otto silent engine is the best that has yet been put on the market in a regular business way. The results obtained by these are exceedingly good, and the only objection that can be urged against them after they are obtained is that they do not burn gas enough. Doubtless this is an objection much more satisfactory to the consumer than to the gas maker; and this objection could be turned to real profit if the gas manager could be sure of supplying any customer, that he might be able to obtain for this motor, within a reasonable time. But it appears that the demand is so great that from three to four months must elapse before an order can be filled by the manufacturers in this country. It seems a pity that this should be the case in a country like ours, and but one result can possibly follow such a method of supplying the demand, and that is that the inventive genius of our land will, sooner or later, develop some other machine, that can be delivered some time within reason, that will do if not as well, at least nearly so.

In the very able address, to be found in another column, by the eminent gas engineer, Mr. John West, Chief Engineer of the Corporation Gas Works at Manchester, England, upon the occasion of the meeting of the Manchester District Institution of Gas Engineers, to visit the Smoke Abatement exhibition then being held at Manchester, he took the true ground, and, as we believe, the only tenable ground with reference to doing away with the smoke nuisance.

To one who has ever visited the black country, so-called, between Birmingham and Manchester, the extent of the evil of the smoke nuisance is doubtless very clearly fixed in the memory. For miles and miles an extended district of iron works, whose fuel is bituminous coal, is covered with a dense volume of smoke, so as to create a pall over the face of the earth in that locality. Large cities, where the fuel is of the same nature, suffer in the same way; and we are not without beautiful examples of this in our own land. There is no doubt that all of this smoke is carbon wasted. It is alike unscientific and non-conducive to health to permit it. Waste brings want in course of time.

There is no doubt but that if, in place of wasting the carbon in the useless and deleterious smoke, the fuel had been first converted into gas, and those portions of the coal not going directly into the composition of the gas had been carefully saved and sent into the tar well and ammoniacal liquor tank; and then if the gas, as fuel, had been applied for heat and power there would have resulted an economy which would be simply enormous. The use of gaseous fuel for heat and power is the true method for abating the smoke nuisance.

The profit to gas makers, resulting from the sale of this fuel, would be great, no doubt; but the financial benefits to be derived by them, in *saving*

the smoke, would enable them, if the business were properly managed, to supply the heat and power at rates that would compare most favorably with the prices of the raw material. It is the saving of the residuals that, in the ordinary use of bituminous fuel, pass off in smoke, can enable the gas maker to compete in cost with the raw material simply from the fact that he thereby saves what is wasted in smoke, while he supplies the heat-giving portions in a form so convenient, so cleanly, so handy, that little is left to be desired.

Mr. West gives some facts, at the close of his lecture, which tend most strongly to confirm this statement, for he says that a 3½-horse power engine of the Otto type, as made by Messrs. Crossley Bros., is operated by fifty-five cubic feet of gas per hour. Now, if the Otto engine can do this to-day, who shall say that better results may not yet be obtained. Many minds are at work on this problem, and it is one to which the gas interest should lend its fullest and heartiest assistance.

If the makers of engines to-day are ready to supply the demand at once, upon the receipt of orders, the gas manager can unhesitatingly recommend his customers to adopt the gas engine in a multitude of applications. Our columns have from time to time borne testimony of their economy, from actual results obtained from these motors. This is well, but the end is not yet, better must come; and waiting three or four months to supply a customer is very apt to chill his enthusiasm, to say the least, even if it be true that if the customer does wait, and does buy a gas engine, instead of a steam engine, he may think himself repaid for the delay.

The time is not far distant when the use of the gas engine will be as universal as is the use of the steam engine to-day. Not that it is claimed that it is to supersede the steam engine altogether; but there will be developed so many new uses for this convenient motor that its applications must increase rapidly.

In view of these facts there is one thing that the gas interest of the country could well afford to do jointly—by mutual contribution, pro rata among the companies, a fund could be established which should be devoted to the development of the gas engine. There are many able inventive minds who would certainly bring forth something good if the means were at command for carrying out the work. A portion of the fund could be devoted to the assistance of men who presented something that seemed to have merit; and, in the end, when it had been determined what was the best, the rest of the found should be given to the originator thereof in lieu of all claims, and the manufacture of that engine thrown open to the world just as free as tenpenny nails or baker's bread.

The True Value of Faure Accumulators.

The capacity and power of the Faure accumulators, or secondary batteries, have been investigated by a Commission appointed for the purpose, carrying on their experiments at the Conservatoire des Arts et Métiers in Paris. The cells used in these experiments, 35 in number, weighed 43.7 kilos. each or a total weight of 1530 kilos., about 3370 lbs. The experiments gave the following results, which have been communicated to the Académie des Sciences, and form the only independent and trustworthy report yet published regarding the apparatus in question.

The accumulators were charged by a Siemens machine, and accurate note was taken of the power required for the purpose. The discharge of the cells was made with twelve Maxim incandescent lamps. Between the quantity of electricity sent into the battery and that given off again there was a difference representing only a loss of 10 per cent. The return of the cells, considered as electrical *quantity*, is therefore about 89 or 90 per cent. With respect to work done, however, it is shown that the battery only gave out 40 per cent. of the total energy required in charging it, and 60 per cent. of the energy actually stored up by it. This calculation must be taken as referring solely to the disposable electrical energy. If this energy is expended upon a motor machine, to be thereby transformed into mechanical work, the duty obtainable is yet further reduced, and there cannot finally be gathered more than 25 per cent. of the work done in the first instance. The Faure accumulator, completely charged, gives in disposable electrical energy 2500 kilogrammeters per kilogramme of weight, equal to a weight of cell of 108 kilos. per horse power per hour, and 150 kilos. per horse power expended in mechanical work under the best conditions. It is therefore evident, as the report says, that perfection has not been yet attained in the matter of reducing weight and increasing the storage capacity of the secondary battery,

It is, however, a sufficient comment on the wild assertions frequently made respecting the possibility of lighting by incandescent lamps maintained in action by secondary batteries of this character, to find it stated on indisputable authority that the waste of force in the process of charging and discharging these batteries is so serious as the figures now given serve to indicate.

Summing up, it has now been demonstrated that the charge of this battery of 35 cells required a total mechanical work of 1.558-horse power during 22h. 45m., which is equivalent to 1-horse power during 35h. 26m. The battery received only 66 per cent. of the work expended, the rest being absorbed in overcoming passive resistances, and exciting the field magnets. Only 60 per cent. of this power stored up was yielded back by the battery; and it is probable that the same result will be forthcoming in all applications similar to lighting by Maxim lamps.—London *Journal of Gas Lighting*.

The Manchester District Institution of Gas Engineers at the Smoke Abatement Exhibition.

At first sight there is something incongrous in the selection of a visit to an exhibition of smoke-preventing appliances as the occasion for a popular lecture on the subject of gas burners. Yet this has been done with much success by the Manchester District Institution of Gas Engineers, who have been engaged in discussing the qualities of burners used for the production of light, as a sequel to their inspection of a collection of articles intended for the utilization of gas as fuel. Before entertaining a conviction of the incongruity of this proceeding, it is, however, well to remember that valuable lessons respecting the combustion of fuel in large quantities for heating purposes map be derived, as was done by Mr. West on the occasion under notice, from its behavior when burnt in the more delicate apparatus used for the development of light. The question of burners for illuminating purposes, again, is never beside the mark, especially where the instruction of the general public is concerned. From the attempts now being made on all sides, and with reason, to popularize the use of gas as a fuel for heating and cooking, to replace coal fires, it might be hastily assumed that the public have nothing to learn with regard to the most obvious and important use of the same commodity. This, as gas engineers know, is far from being the case; and it would scarcely be overstating the facts to say that one-third of all the gas used for lighting apartments is wasted through the use of bad burners and fittings.

While this is even approximately true, lectures and discussions tending to show the difference between good and bad burners can never be out of place. It is a source of satisfaction that matters are not so bad as they once were in this respect. Makers of good burners now meet with ample support, and a standard of efficiency has been set by the higher class burners, mainly used for technical purposes, which has had an excellent effect upon the cheaper and more universally favored goods of the same order. A short time since the waste of gas through bad burners was appreciably worse than at present; but much remains yet to be done to drive bad patterns out of the market. We observe with satisfaction that Mr. West is at one with us in advocating large ventilated burners for indoor use whenever practicable, in place of clustered pendants. This is the next requirement in order that gas may have fair play, and the point should receive the earnest attention of all gas engineers who have the opportunity of influencing the choice of fittings by their consumers.—London *Journal of Gas Lighting*.

Electric Light Wires Underground.

A despatch to the New York Daily *Herald*, dated Chicago, Ills., May 8, 1882, announces the following:

"The new City Council was inducted into office this evening. The Mayor presented a veto message on the ordinance permitting the stringing of wires for the purpose of lighting streets and houses with electricity. The chief grounds of objection were that this ordinance contravened the ordinance requiring wires to run underground after January 1, 1883, and that they would be an impediment to the working of the Fire Department, and would endanger, on account of the strength of the current, the lives of persons liable to come in contact with them. The veto was sustained unanimously."

Another Veto.

The *Sanitary Engineer*, of March 30, contains the information that Mayor Cleveland, of Buffalo, has vetoed the resolution of the Common Council granting permission to the Excelsior Gas Light Company to lay pipes through the streets and avenues. The petition on which the resolution was based proposed to furnish a better quality of gas at a reduced rate. The Mayor holds that there was no guarantee that this would be done. He says:

"I have no doubt whatever that we ought to have cheaper gas. At the same time I am so much opposed to any disturbance of our streets that I am inclined to insist that no new company should be allowed to dig our pavements up for the purpose of laying pipe, unless we have a reasonably sure guarantee that it will secure to us cheaper and better gas."

[From London "Journal of Gas Lighting," April 4.]

Leeds Corporation Gas Supply.

PROPOSAL FOR A DIFFERENTIAL RATE FOR GAS SUPPLIED FOR TRADE PURPOSES.

We have been favored with a copy of a report recently prepared by Mr. Henry Woodall, Gas Engineer to the Leeds Corporation, with the object of showing the feasibility of supplying gas for trade purposes at 1s. 2d per 1,000 feet. For the present, however, the matter will have to remain in abeyance, as a clause in one of the Acts of Parliament regulating the supply of gas by the Corporation, expressly stipulates that no concession shall be granted to one class of consumers over any others burning the same quantity of gas. Whether or not the Gas Committee will recommend the Council to apply to Parliament next session for an amendment of the clause in question remains to be seen. Meanwhile, the report will be of much interest to our readers, and may provoke some useful discussion. It is as follows, being addressed to the members of the Gas Committee:

It has given me great satisfaction to receive your assent to my proposal to submit to you a statement showing how gas for trade purposes may be supplied, with advantage to all concerned, at a price much below that now current. The subject involves a great variety of considerations, and I am afraid it will hardly be possible for me to convince you of the soundness of my scheme without dwelling with some elaboration upon details.

The debit side of the last profit and loss account presented to you, altered in form but not in fact, is as follows:

Profit and Loss Account, June, 1881.

Coal, cannel, lime, wages	£82,416	18	4		
Retort setting	3,321	18	0		
And proportion of general charges in maintenance of works	4,000	0	0		
	£89,738	16	4		
Less residuals	49,762	7	11		Per 1000 Feet.
Cost of gas in the holder	£39,976	8	5	=	6.60d.
Repairs and renewals of mains and service pipes	7,777	17	1	=	1.28
Repairs and renewals of meters	4,292	10	11	=	0.71
General maintenance of works	2,209	17	5	=	0.36
Salaries, collection, inspection, rates and taxes, stationery, etc.	17,803	19	4	=	2.93
Interest on capital	52,140	3	9	=	8.59
	£124,200	16	11	=	20.47

It thus appears that although 18-candle gas can be manufactured and put into the gasholder at 6¼d. 1000 feet, it costs 1s. 8¼d. to deliver it to the consumers' meters. You have by recent resolution improved the illuminating power of your gas to 19 candles, and have adopted a more costly system of purification; which improvements will cost about £12,000 per annum, or practically 2d. per 1000 feet. There are, however, gains and economies which can be confidently relied upon to save in the future about £9,000, and so it will be sufficiently near to speak of 19-candle gas as costing 7d. in the holder. Sevenpence, then, is a fixed charge, which must be paid upon all your make, much or little. What I have now to show is that no other items, or group of items, are of a like constant character.

I begin with "repairs and renewals of mains and service pipes," costing us last year £7,777. The wear and tear of mains is due to oxidation, traffic, and disturbance of roadway, and not in the slightest degree to the passage of gas. If a breakage occurs it costs all the same to find and repair it, and to reinstate the roadway and footpath, whether much or little gas flows through it. A passing load will fracture, or a percolation of water will oxidize a main or service pipe quite irrespective of its useful occupation. It is also a fact that a sluggish flow or stagnation often causes, especially in frosty weather, a deposition of naphthaline, and permits the formation of hoar frost, the removal of which entails such cost that I have calculated there would be a positive saving in keeping the street lamps lighted throughout the day in midwinter, in order to maintain the flow of gas, and so prevent such stoppages as put the public to the inconvenience experienced in the winters of 1880 and 1881.

I will now suppose that instead of 1,500 millions, 3,000 millions pass through our system of mains. The charges will not be increased one penny, but it may be necessary to increase the size of mains to carry the larger quantity. The result would be an addition to capital account, which I will treat of further on; but there would certainly also result a reduction in cost of maintenance and leakage of gas; the larger mains being thicker and stronger, and therefore entailing less frequent attention. To prove that I am not speaking "off the book," I beg to call your attention to a report which I submitted to you in 1876, in which I showed that you leakage in 1875 was 156 millions; and I predicted that when your sale of gas was doubled your loss would be no greater. Six years have gone by. You last year sold 1,287 millions, as against 833 millions—an increase of 454 millions upon the sale of 1875 (54 per cent.)—and your loss is now 145 millions, against 156 millions in 1875; and I confidently assert that were you to again double your present sale through existing plant, you would not increase your loss at all appreciably.

The next items in the accounts—"repairs and renewals of meters"—partake very much of the nature of the last. Meters will cost less rather than more for being kept in use. It is intermittent use that spoils them. When the gas is turned off at the inlet, the air will effect an entrance and corrode; or if the gas be permitted to occupy the meter, and there be no flow through it, there will be a deposition of oily matter from the gas, and oxides from the fittings, in the drum, which will throw it out of balance and necessitate its removal. But as meters are charged for by a rental which covers both interest and cost of maintenance and renewal, this item may well be left out of consideration.

I now come to "general maintenance of works." More than three-fourths of the charges under this head I have already placed to the cost of gas in the holder. The remainder is for the maintenance of yard-paving, buildings, exhausters, condensers, purifiers, gasholders, general painting, etc.—all of which items are practically unaffected by the quantity of gas made upon existing sites. The wind may disturb the roofing of our premises, or cause damage to our gasholders all the same, whether we are meeting a summer demand or a winter's; painting and whitewashing, whether of offices or works, is an annual process not governed by your business; and, generally, it may fairly be said that this item is also unaffected by your sales.

The next group of items—"salaries, collection, inspection, rates and taxes, stationery, etc."—are even less impressionable than the foregoing by the amount of business transacted. It is true that the work of inspection will be increased by the addition of new meters, and that with two prices two bills will have to be made out and collected; but it is contemplated that the new accounts will be for such large quantities that the ratio of these costs will be very small indeed. For example, inspection of meters now costs 1s. 6d. per meter per annum, or practically 1d. per 1000 feet. But for trade purposes the consumption would be so constant and large that the cost spread over the larger quantity would certainly not exceed a farthing on the average of the new business; and a man would only have to burn 4s. worth of gas in a week to reduce this charge to 0.1d. per 1000 feet. It is quite as easy to obtain payment of a large sum as a small one; and as it is not contemplated that the number of our customers will be materially increased by the proposed scheme, so the work of collection will hardly be greater.

I now come to the most important item as affecting the price of gas to the consumer. In Leeds the interest payable upon the capital expended is equal to a charge of 8¼d. upon every 1000 feet of gas made, or nearly 10d. upon every 1000 feet sold. A portion of this charge is due to the inevitable premium which you had to pay to acquire possession of the undertaking from the Companies; but much more to the great cost of works under previous management.

In 1875 the expenditure on plant, exclusive of meters, was at the rate of £918 per million feet of gas made per annum. In 1881 the cost had been reduced to £600. The following table will show how this result has been achieved—

Date.	Expenditure on Plant. Less Meters.	Gas Sold.
1875	£756,907	833,519,000 cubic feet.
1876	779,726	879,813,000 "
1877	795,165	951,663,000 "
1878	812,952	978,125,000 "
1879	820,129	1,063,383,000 "
1880	831,437	1,153,405,000 "
1881	847,936	1,287,144,000 "
Increase in 6 years	£82,029	
Increased sale in six years		453,625,000 cubic feet.

Showing an expenditure on plant during this period at the rate of only £180 per million. And against this expenditure of £82,000 we may set off £50,000 carried to sinking fund.

I need not point out to you how much your plant has been extended and enlarged during this period. It is certainly not too much to say that the capacity of your system of mains has been more than doubled, and you are also well aware that a considerable addition to your works still awaits development. Under these circumstances, I am sure that you will agree with me that an estimate at the rate of £250 per million is a liberal one for the plant required to meet additional business.

Now supposing this capital to be raised at 4 per cent., and that 1 per cent.

be put to sinking fund (making the charge 5 per cent. in all), the interest due to increased sales works out at only 3d. per 1000 feet. This estimate of the cost of works per million feet presupposes that the new business will be of like character to the present. But my proposal is to make abatement on such gas as is used for trade purposes other than lighting. The difference between the two is most important, as I shall endeavor to show.

A gas-works and all accompanying plant must be so constructed as to meet the extreme demand of any time, however limited. It is not only necessary that a sufficient quantity should be made, and stored to meet the greatest demand of any day in midwinter, but the mains must be large enough to carry the maximum quantity required in any hour. Where gas is used mainly for lighting it is manifest that the greatest demand will occur on or about Dec. 21, and the smallest about June 21. As a matter of fact, the variation between the demands of these dates is as 4 : 1. The average sale is reached about March 31 or Sept. 30. The natural result is that at Midsummer three-fourths of our plant is idle, and on March 31 one-half or thereabouts.

The greatest daily make multiplied by 200 gives the annual make. If your daily make multiplied by 365 gave the annual make, it would show that day by day, throughout the year, you had the same demand. Now for trade purposes the demand in summer is presumably as great as in winter, and excepting Saturday afternoon and Sunday, is constant. Deducting a day and a half per week—78 from 365—we have 287 as our multiplier instead of 200. And this shows that a plant put down to meet this class of business would be profitably employed to the extent of 43 per cent. in excess of that for lighting. Consequently if a plant which is used only 200 days in a year can be erected at a cost of 3d. per 1000 feet, similar plant used for 287 days entails a charge of only 2.1d. per 1000 feet But after-considerations require that I should divide the 2.1d. by 3, and charge two-thirds=1.4d. to cost of works and mains, and 0.7d. for holders; and so it appears that works without gasholders can be laid down to work 287 days in the year, at a cost of 1.4d., or, say, 1¼d. per 1000 feet.

That is not all, however, that is to be said in favor of such business. The demand for much of the gas now consumed terminates in midwinter at six P.M., and ceases altogether with the 31st of March. So that, calculated for morning and evening use, it does not average more than four hours per day throughout six months of the year; or two hours taking the year through.

Now for most trade purposes, and I may particularly instance engines, the demand for gas would be equal throughout every hour of the working day (say eight), and as compared with the lighting of factories, is as 4 : 1; or taking the aggregate of the lighting as at least 2 : 1.

In Leeds the economy attending this circumstance is twofold. In the first place the demand for trade purposes being in the center of the town, and closely surrounding our works, the draught upon our mains will prevent the accumulation of pressure throughout the day upon the hundred miles of mains in the higher districts, and so lessen the leakage; and, what is of more consequence, the demand of the day ceasing, the make of gas at night is taken up for lighting, and so the need for gasholders is reduced. Let me make this clearer, for it is a material point.

The exigencies of our present trade require that about 50 per cent. of our 24 hours' make of gas shall be stored to meet the demand in excess of our rate of manufacture at night. Now, the more nearly the sale of gas during the day conforms to that of the night, the less need we have for storage. To take an extreme case as an illustration: Let us suppose a single consumer to work a gas engine during a winter's day from 8 A.M. till 4 P.M.; at 4 P.M. to stop the engine and light up till 11 P.M.; and at that hour to turn off the lights and go to bed in the luxurious warmth of a gas fire. In such a case we might have an unvarying use of gas throughout every hour of the 24. There would be regular work for the retorts, but no necessity whatever for the holders. This is admittedly an extreme illustration, but it is nevertheless appropriate to the times; for everyday experience tends to show that the many uses to which gas can be profitably applied, cause it to be in request more equably throughout all hours of the day and night.

Now gasholders cost about one-third of all our expenditure on plant; and supposing we can in the future reduce our storage to 50 per cent. of a day's make—instead of 100 per cent., which is now generally considered imperative—we thereby save 1¼d. on the present business, and 0.35d. on new business. Thus it would appear that new works can be erected at a charge for interest of 1 75d. per 1000 feet.

Going back to our profit and loss account and my observations thereon, I have shown that gas in the holder costs 7d. per 1000 feet. The remaining charges, excepting interest, amount to 5.28d. per 1000 feet. I have endeavored to show that the sums at present paid under the various heads thus totalized are not materially affected by an increased sale; and I feel assured that an estimate of 25 per cent. on the gross is a liberal allowance. This would be about 1¼d. per 1000 feet.

Interest I have shown as varying under certain conditions, as between 1.75d. and 3d. per 1000 feet. I take the mean, and say 2¼d. Thus we have—

Cost of gas in holder	7d.
General charges	1¼
Interest	2¼
Total	11 per 1000 feet.

At the present time you are certainly not making a fraction of profit upon your business beyond the £10,000 a year that you are required to put to the sinking fund; and so it would appear that upon new business for trade purposes, you would reap a greater advantage (to say nothing of the boon conferred upon the public) at 1s. per 1000 feet, than is yielded by your price of 1s. 9½d. That I have good grounds for my contention will appear by a glance at the revenue accounts for the years 1876 and 1881.

1876—Sale, 883 millions; income from gas	£157,000
1881—Sale, 1287 " "	£115,000
Increased sale, 407 millions; reduced income	£42,000

In fact, it may be said, comparing notes with 1876, that we last year gave away 400 millions feet of gas, and £40,000 with it. Of course we have during this period seen a considerable fall in the price of coal. But when the reduced income from coke is taken into account, and allowance made for higher prices of tar and ammoniacal liquor, the difference in favor of the present time is found to amount to only 9d. per 1000 feet, while the abatement in price is 1s. 9d. at least.

How have the rest of the economies been effected? Very largely through more economical expenditure in plant, and the comparatively fixed character of the charges for interest, management, and maintenance, in face of a rapidly growing business. But the very fact of such large concessions having been made to the general body of consumers presents an argument against the sale of gas for trade purposes at a price which will be unproductive of profit; for it is due to the use of gas for general purposes that we have experienced so large a demand, and it is the growing demand that is enabling us to make still further abatements.

Thus the sale of gas for trade purposes will lop off some of the advantages at present accruing to the public. It is therefore but reasonable that the new business should be made to yield a return that will compensate the present consumers for their loss; and a sum of 3d. per 1,000 feet would, I am sure, be fully adequate for such purpose—for the loss would be represented by a few gas engines, and singeing apparatus at factories, and a few ovens at hotels, cocoa houses, dining rooms, and confectioners. As against this loss we shall undoubtedly receive an immense accession of business, for it is hardly too much to say that there is scarcely any work to which coal is applied that cannot be more profitably performed by such gas as ours at 1s. 2d. per 1,000 feet.

My recommendation to you then is, that for all trade purposes, other than lighting, the price of gas shall be 1s. 2d. per 1,000 feet. I have demonstrated that it can be done at considerable profit, and you have already recognized the principle in your dealings with the Lamp Committee, to whom you have offered an extra supply of gas to existing lamps at a charge barely more than 1s. 1d. per 1,000 feet. A section of your customers may, however, contend that it is unfair to make such a concession to outsiders, while you maintain the price to those who have borne the burnen of high prices in times gone by. My answer is that the present body of gas consumers (taken in the aggregate) are getting and will continue to receive all the extra gas they may demand at less tnan 1s. per 1,000 feet. That is to say, supposing the public, apart from the new section of consumers, to burn an extra 100 million feet for any or all purposes, during 1882-3, the difference between 1s. 9½d. and 1s. on that quantity would revert to the consumers in the following year. I am here presuming that the Committee will hold to the policy which has hitherto been productive of such beneficent results. It cannot be too plainly understood that it is new business that pays; and all that I am proposing to do is to go into unexplored fields, to gather a custom which will yield a high profit, but which are not open to us on existing terms.

(Signed) HENRY WOODALL, Gas Engineer.

Sound Clerical Advice to Workingmen.

The gospel of labor is well expounded and very practically presented in a "pastoral letter" published at the Fourth Provincial Council of Cincinnati, March 9, 1882, and signed by Bishop William Henry, coadjutor of the Roman Catholic Archbishop, and seven Bishops, by whom it is addressed to the clergy of the province. We copy as follows a single extract:

A man's labor is his own. The strong arm of the poor and the skill of the mechanic is as much his stock in trade as the gold of the rich man, and each has a right, as he pleases, to sell his labor at a fair price. Men have

also a right to band together and agree to sell their labor at any fair price within the limits of Christian justice, and so long as men act freely and concede to others the same freedom they claim for themselves, there is no sin in labor banding together for self-protection. But when men attempt to force others to work for a given price, or by violence inflict injury, bodily or temporal, they sin. If men are free to band together and agree not to work for less than a given price, so others are equally free to work for less or more, as they please. All men have a right to sell their labor at such price as they deem fair; and no man nor union has a right to force another to join a union, or to work for the price fixed upon by a union. Here is where labor unions are liable to fail, and in which they cannot be sustained. If one class of men is free to band together and agree not to sell their labor under a given price, so are others equally free to sell their labor at such a price as they may determine upon. Catholics cannot be partners in any attempt to coerce others against their just rights, nor can they by overt or secret acts or violence do injury to the person or property of others. What one man claims for himself he must concede to another.

On the other hand, capital must be liberal toward labor, and share justly and generously the profits with labor, being mindful of the command "not to muzzle the ox that trampeth out the corn," "nor to defraud the laborer of his wages." Capital has no more right to undue reward than labor, nor should capital be unduly protected at the expense of labor. Capital and labor should work hand in hand, and proportionately share the values they have mutually produced. Nature gives the raw material, labor and skill give it its value; capital gives direction and advances reward to labor and skill, waiting until in turn it can realize on its outlays. They are mutually dependent on each other, and should mutually labor for each other's interests—capital recognizing the rights of labor, and labor in turn recognizing the rights of capital.—*Iron Age.*

Annual Report of the Superintendent of the City Gas Works, Richmond, Va.

SUPERINTENDENTS OFFICE,
CITY GAS WORKS, RICHMOND, Feb. 1, 1882.

To His Honor W. C. Carrington, Mayor:

I have the honor to present for your consideration the thirty-first annual report of the City Gas Works, and the result of their operation for the year ending January 31st, 1882:

MANUFACTURING DEPARTMENT.

Coal on hand at last annual report	3,409,930	pounds.
Coal purchased	22,782,340	"
Total coal on hand	26,192,270	pounds.
Less coal on hand January 31st, 1882	1,708,052	"
Coal carbonized during the year	24,484,220	"

Coke made and disposed of as follows:

Coke used in retort house	187,126	bushels.
Coke used in other parts of the works	7,000	"
Coke used at station engine	9,450	"
Coke used at pumping engine	1,800	"
Coke sold to the public	175,035	"
Coke sold to employees	19,725	"
Coke sold to Relief Committee	1,087	"
Coke given to City Mission	9,812	"
Total coke made	411,035	bushe's.

Gas on hand January 31, 1882		167,481 cu. ft.
Gas made as per station meter	112,362,420	
From which deduct 10 per cent. for leakage and condensation	11,236,240	
		101,126,180 cu. ft.
Total		101,293,661 cu. ft.
Less amount on hand January 31, 1881		641,701 "
Amount consumed		100,651,960 cu. ft.
Total public consumption		23,834,010 cu. ft.
Private consumption		76,817,950 "
Total amount consumed		100,651,960 cu. ft.

By reference to the above figures it will be seen that there has been consumed for the use of the city 23,834,010 cubic feet of gas free of charge. The statement of gas generated shows that 112,362,420 cubic feet of gas was made, showing an increase of 14,949,320 cubic feet.

At the date of last report there were 1,221 public lamps. During the year there have been added 11, making in all 1,232.

At the date of last report street mains measured as follows: 47 miles; laid during the year, 2,215 feet; making in all 47 miles 2,215 feet.

In addition to the above there have been put in for new consumers 111 service pipes.

During the improvement of Main street, from 8th to 14th, there were 120 old and worn-out services taken out and renewed with galvanized iron pipe. We have also renewed and repaired 160 service pipes of various sizes, in different parts of the city.

We have repaired, adjusted, and repainted during the year 596 meters of various sizes, and have made, repaired, and repainted 313 street lamps.

We have lowered 511 feet street main to suit the alteration made in the grade of streets, and recaulked all the joints in the main pipes on Main street from 8th to 14th street—all being in a leaky condition.

The maximum production of gas in any one 24 hours was on the 22d of December, 1881, which was 526,000 cubic feet.

The maximum consumption in any one 24 hours occurred on January 21, 1882, amounting to 569,375 cubic feet.

In the month of December there were manufactured 13,840,200 cubic feet; consumed in the same month 13,662,730 cubic feet.

There are 3,492 meters in use.

The auditor reports the disbursements and receipts on account of current expenses as follows:

Received for gas		$152,586 85
Received for coke		11,832 95
Total		$164,419 80
Disbursed for expenses	$83,633 19	
Disbursed for coal	53,188 21	
		136,821 40
Excess of receipts over expenditures		$27,598 40
To which must be added 23,834,010 cubic feet of gas consumed by street lamps and public buildings, at $2 per thousand		$47,668 02
9,812½ bushels coke to the City Mission, at 6 cents		588 75
To amount ammoniacal liquor furnished Va. Chemical Works		1,092 81
Total in favor of the works		$76,947 98

The average candle power of the gas was 16.98 candles.

I had during the past summer gasholder No. 1 thoroughly repaired, since which time it has worked smoothly, much better than when it was new, 31 years ago; and I have no doubt that if it is carefully managed it will be durable for 30 years to come.

At no time since the works were built has the prospect for the future been brighter than at the present; the causes affecting injuriously the value of gas property during the past 5 or 6 years have been removed, or are better understood. This is now admitted in this country and in Europe, and is evidenced by the increased value of gas stocks, and the large amount of capital that is at this time being invested in the building of new gas works, and in the extension and improvement in existing ones all over the world.

The largest holder ever built is now being put up in London, and new works on an immense scale are being built for the corporation of the city of Manchester, England; and it is the concurrent testimony of the men in the business in this country that the present year will be one of unexampled activity in the way of enlargement of works and extension of pipes.

The reasons given for this improvement in the condition of affairs are that the gradual reduction in the price of gas is popularizing its use, the increase of population in cities, and the general improvement in business. It is generally admitted, too, that oil cannot be sold any cheaper, while gas can be; and as the times improve, the people will and are using it more freely.

It is the opinion of the best informed that the electric light will have its uses, but at the same time will be a benefit rather than a disadvantage to the gas business, by cultivating a taste and a desire among the people for more light; and it has already had that effect, as can be seen by the fact that in the reports published the increase in the consumption of gas has been greater the past year, and that the most extensive improvements are contemplated where the electric light has been longest and most used.

It is fair to infer then, that when business men and capitalists are so willing to put more money into gas property, they can have but little fear of the electric light doing them harm.

That it was wise and prudent in our city to own her own gas works becomes more apparent as time rolls on; her ownership prevents opposition works or imposition, and it is now generally admitted that one gas works can supply gas cheaper than two in the same city; and the profits made by the works go into the treasury, and are equivalent to relieving the people

of that amount of tax, besides the works are becoming more valuable every year.

The entire apparatus and machinery in use at the upper and lower works are in good order, and we are now preparing plans in detail to submit to the Committee on Light for remodeling a portion of the retort house so as to afford more generating capacity to meet the imperative demands of next fall and winter; as the increased make and consumption of gas the past year is truly amazing, and admonishes me that the improvement should be made at an early day.

In conclusion, I cannot refrain acknowledging the courtesy and marked efficiency of the officers in charge of the various departments of the works.

All of which is respectfully submitted.

JOHN H. KNOWLES, Superintendent.

Annual Report of the Jamaica Plain Gas Light Company.

The Directors of the Jamaica Plain Gas Light Company present to the stockholders their report for the year ending March 31, 1882:

Received for gas	$49,667 16	
" coke and tar	3,038 78	
" interest on loans	533 52	
" for jobbing	620 02	
		$53,859 48
PAYMENTS.		
Labor at works	$5,704 50	
Coal	14,510 98	
Salaries	4,266 67	
Lime	536 80	
Meters	287 15	
Taxes (State and City)	3,635 92	
Street work	1,707 92	
Retorts	720 52	
Pipe	571 79	
Hay and grain	317 99	
Office rent	200 00	
Printing and stationery	134 05	
Repairs	672 66	
Incidental expenses	896 38	
		$34,166 33
Net earnings for the year		$19,696 15
From which two dividends have been paid of $4 per share each		16,000 00
Leaving a surplus of		$3,696 15
To which add the surplus on hand April 1, 1881		24,966 39
Making present surplus of profits		$28,662 54

It will be seen from the above statement that the net earnings for the past year are $19,696.15, which is nearly 10 per cent. on the capital stock; and after paying our customary dividends of 8 per cent., has enabled us to increase our surplus in the sum of $3,696.15, making it at the present time $28,662.54.

This is the most gratifying and satisfactory year's business that the Company has had in its 27 years of existence.

To enable us to keep pace with the improvements that have been made in manufacturing gas, as well as for the reason that our business has outgrown the capacity of our works (as for 20 years they have been comparatively unchanged), the Directors have thought it necessary to make extensive enlargements and improvements. New and substantial retort and purifying houses are nearly completed, in which will be placed benches of retorts of large capacity, and purifiers of a size and quality that will be adequate to our business for many years to come. With the completion of these, and the addition of a new and improved condenser, exhauster, and station meter, the Company will have a set of gas works equal in efficiency to any in New England, and should produce, with proper management, as satisfactory results.

For twenty-five years, with one brief interruption during the war, the Company has divided 8 per cent. per annum upon its capital stock; and it has been our policy to give to our consumers, in a reduced price of gas, all the excess of profits, after retaining a moderate reserve, over that sum. This, it is to be hoped, will be our future policy.

There can be no question that not only a brilliant illuminating gas, but a cheap gas, so cheap that it can be used for cooking and heating, is and must be the great object of gas companies to manufacture; and with this object steadily in view, economies must be practiced, and every useful and well-tried improvement utilized.

The Directors confidently hope that with a continuance of general prosperity, the time is not far distant when a reduction can be made in the price of gas, and our regular dividends at the same time be maintained.

Our capital remains where it has been for several years, $200,000, with no debt whatever, and a surplus, as appears above, of $28,662.54. The new buildings and other improvements that are now in progress will cost about $30,000, and will be paid for from our surplus, and it will not be necessary to issue new stock for this purpose. It has been the policy of the Company, for several years, to charge all repairs, improvements, and extension of street mains to expense, not adding a dollar to construction account, and keeping the capital account to its present moderate amount.

It is creditable to our customers, as well as to the efficiency of our officers, that only $12.15 was last year charged off as bad debts—about one-fortieth of one per cent. of our gross earnings.

In behalf of the Directors,

April 1, 1882. JOHN C. PRATT, President.

BALANCE SHEET, MARCH 31, 1882.

Dr.

Gas works	$200,000 00
New gas works	255 62
Notes receivable	1,000 00
Cash	17,806 92
Coal	9,600 00
	$228,662 54

Cr.

Capital stock	$200,000 00
Profit and loss	28,662 54
	$228,662 54

[From the London "Journal of Gas Lighting."]

Burners and Various Gas Apparatus in Use for Domestic and Other Purposes.

At a special meeting of the Manchester District Institution of Gas Engineers, held on Saturday, April 15, Mr. John West, the Chief Engineer of the Manchester Corporation Gas Works, read the following paper on "Burners and Various Gas Apparatus in Use for Domestic and Other Purposes:"

Although, as an Institution, most of us met together last month to listen to the President's inaugural address and an important paper in connection with our profession, it was thought desirable by our Committee that we should again assemble together, to inspect and discuss the various gas appliances now being shown at the Smoke Abatement Exhibition in this city, with the object not only of educating ourselves, but of carrying away, into the various local centers to which we belong, any valuable information that might be obtained; which information must tend to the mutual benefit of the consumers, as well as of the corporations and companies whom we represent. It was therefore arranged that when the inspection of the various apparatus had been made, and after the President had introduced the subject, I should read a paper which might afterward be discussed. I must, however, inform you at the outset that it was suggested to me that the chief object the Committee had in view was the dissemination, amongst the consumers generally, of knowledge on the economical principles of burning gas; and therefore that I should avoid the technical, and lay the matter before you as simply as possible. I shall necessarily have to take up a little of your time, and traverse ground that is familiar to some of you, and therefore must ask your indulgence.

My experience of the ill effects caused by the waste of fuel in the form of smoke, and the escape of noxious vapors, during the short time I have been in this district, needs no apology from me for addressing you, from a gas engineer's point of view, as to the object of the exhibition. The Manchester Institution of Gas Engineers feel deeply interested in this matter. I have much pleasure in being the medium of the Institution on this occasion, and beg to inform you that the corporations and companies to which we belong do claim to furnish means by which, in a very great degree, the smoke nuisance would be abolished. I mean, of course, the consumption of gaseous fuel already prepared for your use; for, after all, the smoke question simply resolves itself into a more or less complete transformation of the solid material into a gaseous state, followed by the more or less complete combustion of this gaseous fuel. It is the latter action which decides whether gas fuel thus produced shall issue forth as injurious smoke, or shall give up for some useful purpose the heat contained in it. The essential conditions required for the more beneficial action are means by which a nicely-balanced system of air supply, according to the requirements of the various kinds of fuel undergoing combustion, can be supplied.

To give you a simple illustration of the different effects produced by altering the air supply to a matter undergoing chemical rearrangement, commonly called combustion, allow me to call your attention to this standard Argand burner of Mr. Sugg [burner shown], which, from the fact of its requiring a chimney to assist it in consuming the air properly, offers very special facilities for adjusting the channels by which the necessary air enters, so that this air can be very closely limited to the requirements of the gas. You will notice that the gas is burning steadily and without smoke visible to the eye. I will now slightly stop the aperture below the burner, and you at once see precisely what is continually happening in nearly all the fire grates at present in use—viz., the gaseous portion of the fuel is here represented as being rapidly evolved from the solid portion, and not getting a systematic proportionate supply of air in a proper condition, escapes unburnt to pollute the atmosphere.

I will now offer you another side of the question. If I take a tube, and blow a gentle blast of air into the base of the burner, we get a more energetic and complete combustion of the gaseous fuel; but this is obtained by sacrificing valuable heat, which is uselessly escaping up the chimney.

To the uninitiated this will give a fair representation of the question of the smoke nuisance, so far as domestic purposes are concerned; and the point to be observed, if you wish to burn fuel in an open grate economically and perfectly, is to select grates in which special provision has been made to deal with the valuable gaseous portion of the fuel, and to avoid the existing nuisance of smoking chimneys, There are a great number of fire grates professing to deal with this difficulty, but with few exceptions they depend upon mechanical movements. I do not, however, propose to go into the subject of fire grate construction generally.

To a great extent we are prepared to offer the public gas suitable for domestic use, and though we cannot at present speak so freely of its application to many manufacturing purposes, attention has been directed with considerable success to arrangements which make me very sanguine that it will ultimately become the practice to use gas for many operations. In this exhibition are two very successful instances of its application—the baker's oven and the annealing kiln of Messrs. Thompson Bros., of Leeds. In this apparatus, as in the Argand burner, special facilities exist by which the air supply is regulated, so that the gas may burn to the greatest advantage.

I do not pretend to say that the use of gas as fuel is going to end the trouble under present circumstances; for, unfortunately, the combustion of gas is too often not carried out in a manner suitable for the object in view, either for lighting or heating purposes, and there is, and will no doubt continue to be, a very large waste annually of gas escaping from defective burners. This question of waste in the consumption of gas for lighting purposes is one in which for many years I have taken a great interest, and it has always been my practice to try and educate gas consumers up to the best means of using gas economically, by keeping before them the latest improvements in gas burners, etc.

Before commencing my remarks on gas burners, it is advisable that I should explain, in a simple way, the phenomena of combustion. This is a chemical question, and consists practically of the separation of the elements which form the compound body we call gas, and their rearrangement into other compounds totally different from their original constitution.

In the distillation of coal for the production of gas there are more than fifty known different chemical compounds formed, and probably many more to be discovered. By the various processes of purification, most of these are left behind at the gas works, and practically there are about nine different compound substances existing in the gas before you. These may, for our present purposes, be classed broadly into two divisions—viz., the light and the heat giving portions. Measuring the gas by volume, the light-giving constituents form a very small percentage of the whole bulk, the principal of which is made up of hydrogen—by itself a gas of intense heating power, but containing no illuminants. The next principal proportion of the bulk is a compound of carbon and hydrogen, familiarly known to us as the marsh damp of coal mines. This compound is the poorest in carbon of any of the combinations of carbon and hydrogen; but, having a little carbon, there may be said to be a very slight luminosity in the flame, though not enough for any practical purpose. The two substances may be said broadly to form more than 80 per cent. of the bulk of the gas, the remaining portions being made up of compounds of carbon and hydrogen—very rich in carbon, to which the illuminating power of the gas is due—and of various diluents in small proportions.

These light-giving compounds, commonly spoken of both as the olefiant series and the hydrocarbon series, consist entirely of carbon and hydrogen in a state of chemical union. Both these elementary bodies have an affinity for oxygen. There is, however, a greater affinity between oxygen and hydrgen than between carbon and oxygen, so that under certain circumstances it is possible to make the carbon portion of the compound visible to the eye. This may be done by limiting the air supply to a flame, as I did with the Argand burner, so that there was not enough oxygen in the air supplied to satisfy both requirements: consequently, from the greater affinity between oxygen and hydrogen, the hydrogen was severed first, but the carbon, not having the opportunity of combining with oxygen, passes off in a visible smoke, which ultimately settles as a very finely divided powder. You will notice also that with this incomplete combustion the luminosity of the flame is greatly diminished. Another means by which we can, so to speak, condense the carbon into a solid visible form is by introducing into the flame a chill, such as a cold plate of iron, when we shall soon see the surface of the plate covered with a film of black carbon particles.

Assuming, however, for our purposes, that fairly complete combustion does take place, the following principal chemical changes occur:—The hydrogen and carbon combine distinctly and separately with the oxygen of the air, producing heat, which is a characteristic of combination into which oxygen enters. The hydrogen combines readily with the oxygen of the air, and with it forms watery vapor. [The bottle of water I have here is a specimen of such; and is actually water I have collected from the combustion of 10 feet of gas.] The hydrogen having chemically separated from the carbon, the latter is practically forsaken in a minute solid form, in which state it is ultimately carried by the current of issuing gas to the outside edges of the flame, where, it being also able to reach oxygen, it combines with the same to form carbonic acid. Before joining in this last stage, however, these particles of carbon, being subjected to the intense heat produced by the vigorous combination going on between the hydrogen and the oxygen, are changed to white and yellow; and it is to the existence of the great multitude of these infinitely small particles of carbon, raised to a great heat, that are due the brilliant bands of yellow that we notice in our luminous flames. The important part heat plays in promoting the luminosity of gas flames is well exemplified in the extraordinary power of improved burners like those of messrs. Siemens Bros., which are employed in illuminating this exhibition.

For the purpose of comparison, and to show that a very large number of inferior burners are still being used, I obtained the burners now before you from a few of our customers, in close proximity to each other, in a street near one of our gas works. You will observe that they are very imperfect burners, and that the loss of illuminating power by their use amounts in most of them to 30 per cent. These burners are a type of those almost universally used for domestic purposes during the first forty years of gas lighting, and I think the facts now before you show the importance of discussing the subject, because, although very good burners have been produced and offered to the public for the last fifteen years, they have not readily availed themselves of their advantages.

The investigation made by the Metropolitan Gas Referees in London, in 1869, into the various burners offered to the public, as well as those in use at some of the large business establishments in the City, and in the offices of the daily newspapers, showed that the light produced from these latter burners only had an illuminating power, when compared with Sugg's standard Argand burner, equal to about 50 per cent. of what was obtainable from the gas. All old and inferior burners are made of iron, and are liable to corrode at the orifices. The burners now before you have been tested against a standard burner which, when consuming gas at the rate of 5 cubic feet per hour, gives an illuminating power equal to 20 sperm candles of six to the pound, burnt at the rate of 120 grains per hour. The results are given in Table I.

TABLE I.

Kind of Burner.	1-inch Pressure.				1½ inch Pressure.			
	Consumption	Actual Illuminat'g Pow'r	Candles per cu. foot.	Candles per 5 cu. feet.	Consumption	Actual Illuminat'g Pow'r	Candles per cu. foot.	Candles per 5 cu. feet.
1. Triple fishtail	10.43	25.86	2.48	12.4	.....	Roars	.....	.....
2. Double-slit batswing	6.44	18.8	2.92	14.6	7.9	20.4	2.58	12 9
3. Fishtail.....	2.52	6.7	2.66	13.3	.....	Roars	.....	.....
4. Triple fishtail.....	10.5	36.77	3.5	17.5	.....	"	....	.....
5. Batswing	4.36	11.59	2.64	13.2	.....	"	.....	.....
6. "	5.62	20.81	3.7	18.5	.....	"	.....	.....
7. Patent economizer, with No. 4 burner	4.38	13.6	3.12	15.6	5.6	15.8	2.8	14.0

Note.—The illuminating power of the gas, as tested by the standard test burner, gave a light equal to 20 candles at the time these experiments were made.

The first is that known as the triple fishtail burner. It has holes pierced at the top at right angles, the streams of gas issuing through each of these orifices impinging one against the other, and producing the shape of the flame; and you will observe that when consuming at the rate of 10.43 cubic feet per hour it only gives a light equal to 12.4 candles as compared against the standard burner. No. 2 is a double-slit batswing. The flame being thicker, gives slightly better results; but most of the remaining burners you will see give poor results for the quantity of gas consumed.

It was formerly the universal practice to allow gas to pass to the point of ignition, depending upon the pressure for the spreading of the flame; and at one time so little was known on this subject that contracts were made for public lighting, stipulating that the flame should measure a given number of inches across. We are now aware that this practice was decidedly wrong, and that it is necessary to thicken the flame, and regulate the pressure and air supply, in order to get the maximum amount of light contained in the gas. This principle has been worked out in the modern burners, all of which were made with steatite, adamas, porcelain, or other earthenware tips, and have the means, in a greater or less degree, of regulating the flow of gas to the point of ignition. Most of these burners have been forwarded to me from exhibitors in this building, and other makers, for the purpose of instituting experiments for this meeting.

The results of the testings made are given in Table II.

TABLE II.

Kind of Burner.	1-inch Pressure.				1½-inch Pressure.			
	Consumption	Ill. Power.	Candles per cu. foot.	Candles per 5 cu. feet.	Consumption	Ill. Power.	Candles per cu. foot.	Candles per 5 cu. feet.
1 Sugg's 50 candle Argand	.....	.....	.....	.....	12.11	60.22	4.97	24.85
2. Bronner's No. 5	4.75	18.38	3.87	19.35	5.9	22.07	3.74	18 70
3. Sugg's Christiana	3.85	16.94	4.27	21.35	3.68	15.34	4.17	20.85
4. Sugg's No. 5 flat-flame	4.2	17.44	4.15	20.75	4.37	18.56	4.24	21.20
5. Sugg's incorrodible	4.4	17.54	3.98	19.90	4.51	17.53	3.87	19.40
6. Sugg's hollow-top steatite	4.17	17.77	4.25	21.25	4.56	19.02	4.17	20.85
	½-inch Pressure.				1-inch Pressure.			
7. Bray's 30-candle power	6.37	28.92	4.42	22.1	10.04	46.76	4.67	23.35
8. Bray's "Special," No. 5	3.86	16 47	4.27	21.35	6.11	25.82	4.22	21.10
9. Bray's union jet. No. 5	2.54	9.99	3.93	19.65	2.99	12.67	4 24	21.20
10. Bray's enamel regulator, No. 5	4.36	17.42	3.99	19.95	7.16	27.26	3.81	19.05
	1-inch Pressure.				1½ inch Pressure.			
12. Borradaile's, with governor.	3.75	14.89	3.96	19.83	3.62	14.37	3.96	19.83
12. Peebles', with governor	3.67	13 99	3.81	19.03	3.78	14.17	3.74	18.71
13. Thorp & Tarker's	3.75	15.00	3.98	19.93	3.86	14.57	3.77	18.85
14. Heron's dupiex, No. 4	5.01	21.18	4.22	21 1	6.80	26.91	3.95	18.75

Note.—The illuminating power of the gas, as tested by the standard test burner, gave a light equal to 20 candles at the time these experiments were made.

We have seen that air forced into a flame destroys the light giving properties, so, on the other hand, if gas is forced boisterously into the atmosphere, you have the like results. It is the different ways in which the gas issues from the various burners which cause the difference in the amount of light. In one case we have burners which require more pressure to force the gas through the small orifices; in the other case the gas streams forth gently into the air, and quietly draws to itself the necessary amount of oxygen. In the latter condition we get the most light from the gas. In the standard Argand burner the gas is allowed to issue from a number of small holes at a very low pressure, and the current and quantity of air are regulated by the use of the chimney. If the supply of air is not sufficient to combine with the quantity of gas issuing from the burner, the oxygen combines with the hydrogen and such of the carbon as it is equal to. In this case the remaining particles of carbon leave the upper part of the flame in the form of smoke, and it is proved that all burners give their maximum amount of light relatively to the quantity of gas consumed when the flame is just on the point of smoking.

As regards flat flame burners, the draught or inflow of air upon the flame depends greatly upon the velocity at which gas issues from the burner; in fact, it is the chief regulator of the air supply. Every flame, by its heat, produces an upward current which draws into its sides the surrounding atmosphere; and the greater the draught made by the flame, the more air is drawn into it, the result being that there is an excess of oxygen which quickly destroys the solid particles of carbon in the gas, instead of allowing them, as in the Argand and proper burners, to remain in a state of suspension for a short time.

The Brönner burner, having a fixed regulating orifice and an expanding chamber below the point of ignition, and fitted with Cornelian globe, with large openings at the top and bottom, was designed to neutralize the tendency to cause the current to impinge on the flame (which practice is so detrimental in all globes with small openings), and large enough at the top to admit of the flame retaining its natural shape. This combination was first introduced by Mr. Julius Brönner, and has caused a general departure from the old practice both in burners and globes. Long, however, before Mr. Brönner introduced his burner, the benefit of obstructing the passage of the gas after passing the tap on its way to the point of ignition was fairly understood, and the common way in which this was carried out was generally by the use of a small bulb below the burner, which was fitted with some porous material through which the gas had to filter; but, in many cases, this soon became clogged and corroded, rendering the burner useless until it was taken to pieces and cleared out.

To Mr. Brönner, I believe, is due the honor of first introducing a burner dispensing with these bulky obstructions, and employing at the base of the burner a small aperture just large enough to pass the requisite quantity of gas at a certain pressure through it. I will show you a simple experiment which explains the construction of this burner, and the advantages it has in increasing illuminating power. For our purpose we will take this irregular shaped flame, which is giving such an insignificant amount of light for the quantity of gas consumed, and will place this steatite nipple, attached to the small flexible tube, over the same. I now have the principle of this burner; the holes in the iron nipple representing the regulated aperture at the bottom, the piece of tube the expansion chamber. The exit at the point of the burner is much larger than the slit below; thus the velocity of the gas to the point of ignition is considerably reduced, with the result here shown—viz., a decided increase in illuminating power.

I have dwelt on the Brönner burner because it is the principle that has been carried out in a modified form by various other makers.

Mr. Sugg, to whom gas vendors and the public are much indebted, was the first to produce in this country an Argand burner constructed upon scientific principles. He had for years been working in this direction with Dr. Letheby and others, and finally produced his No. 1 Argand, which gave an increase in illuminating power of about 2 candles over the old Argand. This burner is almost universally adopted as the standard burner, and has been used in most of the official testing stations in England ever since its introduction. He has effected still further improvements in this class of burner, and has likewise very much improved the batswing burners, which he now makes of steatite with hollow tops, at the same time cutting the slits with a circular saw, which very materially improves the the shape of the flame. He also provides a projecting ring round them, to prevent the upward current of the air impinging direct upon the flame. Some of these are made with an adjustable screw at the bottom, so that the consumer can regulate them with advantage when fixing; and Mr. Sugg knowing, from his experience in connection with public lighting, the great advantage of governors, began to add governors with flexible dirphragms to his burners for domestic purposes. Except for large burners these large governors were objectionable; but I find it has been met by the adoption of the small metal regulator of the type introduced into this country, chiefly for public lighting, by Mr. Borradaile; and with these beautiful instruments a steady light is maintained, practically the same amount of gas being consumed under varying pressures. The Christiana and other burners, as you will see, are very handsomely got up in a variety of beautiful designs and patterns, and are of the very best workmanship. This, however, increases their price, and no doubt stands in the way of their general adoption.

In the exhibition I also notice that the Lancashire Meter Company show the Borradaile automatic regulator with suitable globes. A very good governor, known as the "needle" governor, is also made by Messrs. Peebles of Edinburgh. Those of Messrs. Thorp and Tasker are also very good. I have tested all these automatic regulators at various times, and cannot speak too highly of the very great advantages which would be obtained from their general adoption.

We are all indebted to Mr. G. Bray of Leeds, for producing his "special," a burner, which leaves no excuse for the poorest consumer to waste his gas. This gentleman has supplied us with an article practically as good and perfect as some that are being sold at three times the price. These burners have fixed orifices at the bottom similar to the Brönner burners, and sometimes have regulators attached to them,

Mr. Heron, our townsman, shows his duplex arrangement of burners, consisting of two jets arranged side by side a little apart at the base, but close together at the tops of the flames. This arrangement is intended to heat the column of air being drawn between the two flames, by which means an increased illuminating power is produced. These burners have also fixed orifices.

You see that by the use of governors we can regulate the gas to the burners. These instruments are made of any size, and are often attached to the pipes near the meters, in which position they compensate for the varying pressures we are obliged to have in the mains. There is no doubt that when these regulators are fixed they are an advantage to the consumer.

My own idea of the best means of lighting both public and private rooms is to dispense as much as possible with small burners, and use larger ones, with chandeliers and lamps arranged so that the products of combustion would be carried off, at the same time utilizing them for ventilating the rooms. This has been done in isolated cases for many years, and I am pleased to see a lamp that is exhibited here for this purpose by Messrs. W. & B. Cowan. The principle is also carried out in the high-power lamps that are now being used for public lighting, to which subject I propose to direct your attention for a few minutes.

The public lighting of our thoroughfares and large buildings especially has been forced upon our attention by the introduction of our friend the electric light. I say this because up to that period, with the exception of Messrs. Wigham's high-power burners, which have been found to work so beneficially for lighthouse purposes, there was no opportunity given to the vendors of gas or the makers of gas burners to show what could be accomplished with large volumes of gas of great intensity for public lighting. Gas companies and corporations were very anxious to see if a better system of lighting could not be carried out, and the late Phœnix Gas Company, of London, were the first to light up Waterloo Road with larger burners. The arrangements were carried out by Mr. Corbet Woodall, assisted by Mr. Sugg, with his batswing and high-power burners, with very great success. The large Argand burners are of very great intensity, and very ingeniously arranged with rings of steatite, having the air space nicely adjusted between them. The specimen which I have here gives a light equal to 200-candle power. Mr. Bray also came quickly into the field, and advocated his large thick flat-flame burners arranged in close juxtaposition to each other, with small bars to protect the flame against injury from the upward rush of air, a large number of which burners he has fixed in London and other places, not forgetting our own city, where lights have been erected by the Gas Committee in Piccadilly, Market Street, and Deansgate; and I am informed by many who have seen most of the public lighting at other places that this is the best of the kind.

TABLE III.

Description of Burner (Siemens').	Date of Test.	By whom Tested.	Consumption of gas, cubic feet per hour.	Light obtained in candles.	Light given per cubic foot, 16-candle gas.
Flat-flame	Sept. 8, 1881.	T. W. Keates.	6.70	36.0	5.30
No 2	Sept. 24, 1881.	" "	21.50	118.0	5.50
Flat-flame (without glass)	Jan. 2, 1882.	" "	6.60	38.4	5.80
No. 1	Mar. 15, 1882	" "	58.32	341.0	5.85
No. 1	Mar. 16, 1882	F. W. Hartley.	60.00	357.0	5.953
No. 1	Mar. 20, 1882.	Chas. Heisch.	60.00	376.0	6.64
Flat Flame	Mar. 20, 1882.	" "	6.45	43.52	7.13

We have now a choice of two kinds of high-power burners for public lighting; and, taking all circumstances into consideration, I must say that I prefer the flat-flame burners as now being fixed by Messrs. W. Sugg & Co. and Mr. Bray in their special lamps, which are specimens of the advantages obtained by keeping a steady air supply, free from draughts, the air being warmed to a certain extent between the cluster of burners.

Mr. Douglass, of the Trinity House, has, I understand, also produced a very powerful burner of great brilliancy; and, lastly, we have the regenerator burner of Messrs. Siemens Bros., specimens of which we have lighted in this building. In their arrangement both the air and the gas are very highly heated before combustion; the result being a great increase in illuminating power. In Table III. are given a series of tests made by experts with these burners, and you will find that they show a marked increase in illuminating power for the quantity of gas used.

I now come to that part of my subject which is perhaps more closely connected with the smoke abatement question—viz., the use of gas for cooking and heating purposes, the advantages of which have been known and set forth by eminent authorities.

More than forty years ago the late Mr. James Sharp, of Southampton, first made, at Northampton, cooking apparatus in various forms on a large scale, and gave several lectures upon the subject. Mr. E. Goddard, of Ipswich, Mr. Magnus Ohren, of Sydenham, and many others, have since that time been trying to introduce the use of gas in various ways other than for lighting purposes; and although great success has been achieved in some districts, it was not until large firms made the manufacture of cooking apparatus a specialty, which by freely advertising brought the subject so prominently before the public, that much progress was made. Afterwards came the several exhibitions inaugurated and patronized by corporations and gas companies in Birmingham, Leeds, Edinburgh, Glasgow and Manchester, and most other towns, which no doubt have been more effectual than any other means previously employed in pointing out the advantages to gas consumers of utilizing the gaseous fuel they have at their disposal for cooking purposes, the use of which would tend to their pecuniary advantage and comfort.

Mr. F. W. Hartley, who has had considerable experience in this matter, read a paper thereon before the British Association of Gas Managers, at their meeting in London in 1872, and gave the results of some extensive experiments, which were corroborative of those made by many others; and I cannot do better than quote his words upon the subject. He remarked:

"It is sufficient to say that with gas there is no time wasted in the making and waiting for a fire to burn up, and the labor is nothing. The gas has only to be lighted and adjusted, the food put into the oven, and it may be so nicely timed, with very little experience, as to require no attention until it is done and needs taking out. As to economy, Mr. Ohren's experiments, which are quite concordant with others made by the writer, show that the cost of cooking joints, reckoning equal weights, is on the average 2.37d. with gas, and very nearly 4d. with coal, while the absolute waste or loss of weight is twice as much, at least, with fire cooking, as with gas cooking. Even if the fire be utilized for boiling purposes, and the gas be used for both roasting and boiling, the writer found that gas was by far the most economical in relation to the weight of the food cooked. The writer's experience also leads him to the conclusion that in cooking vegetables, puddings, etc., it is far more economical on most occasions to effect the cooking by steam than to employ the gas directly for boiling. The writer may mention a useful hint of the late M. Soyer, the great cook, to preserve the juices in boiled meat, and ensure its tenderness. "Dip it in boiling water for a few minutes and then immerse in cold water, and raise it to the boiling point, and simmer until cooked." Apply this idea in gas roasting, raise the gas for a short time, and then adjust to the requisite consumption. In such cases coagulation of the surface is effected, and the juices are imprisoned, or, at all events, in roasting, the surface is coagulated more promptly. The writer thinks that the facts and reasonings which he has adduced, certainly show that gas, as applied for cooking, is—in comparison with other fuel—more healthful; more certain; less troublesome; less expensive; less wasteful through loss of weight; less costly (unless, indeed, the waste heat from a necessary fire be employed); while, lastly, it certainly is much cleaner."

To fulfill all necessary conditions, a good stove should maintain uniformity of temperature without variations, and should have good ventilation, so that the products of combustion and the vapors expelled from the food can freely escape. Judging from the inspection I have made at this exhibition, there are some of the best stoves that can be obtained, leaving little to be desired, and in point of finish cannot well be surpassed.

A very large and handsome roaster, constructed by Messrs. Slater, of London, is, from its construction, doubtless more effective than those with open bottoms, from the admission of air at the top, which passes down between the tiles and the outer casing, and is discharged into the oven at a high temperature, which supports combustion, and effects a saving in gas. Messrs. Elliott, Alston, and Olney, Messrs. Green & Co., and other local makers, show a very large number of domestic stoves manufactured by Beverley and Wilde, J. Wright and Co., Charles Wilson, and other makers, with a view to economy in the consumption of gas. Most of these stoves are double-cased, and packed with non-conducting material for the retention of the heat.

Among the other gas stoves exhibited here is Cox's regenerator cooker, the construction of which is based upon lines both scientific and practical; and it shows a very careful study on the inventor's part of what is really necessary in an efficient gas cooking stove. There are three points of utility specially aimed at—viz., how to burn the gas to the greatest advantage; the conservation of the heat, and distributing of the same to points where it is most required; and, finally, the perfect ventilation of the stove from the products of combustion and the vapors of the viands cooking therein. I feel some diffidence in saying as much as I ought respecting this inventor's various apparatuses, as he was with me for several years; but, knowing the special attention he has given to this department, I must say I am not surprised that he has produced such improvements. A test was made with one of these stoves last week, the weight of the food and quantity of gas consumed being as follows:—3 quarts of oxtail soup, 6 lbs. of codfish, 2 lbs. of stewed eels, 3 lbs. of boiled potatoes, 3 lbs. of baked potatoes, 13½ lbs. of sirloin of beef, and a sweet omelette for six persons. Consumption of gas, 35 cubic feet, costing, at 3s. 6d. per 1,000 feet. 1.47d.—or, roughly speaking, 1½d.—for the whole dinner. You will observe, however, that the price of gas was taken at 3s. 6d. per 1,000 feet; but if calculated at 2s. 8d. per 1,000 feet, the price of Manchester gas, the cost would only amount to 1¼d. The stove was quite cold when cooking was commenced.

Those who are connected with corporations and gas companies should adopt and recommend those stoves only that fulfil the necessary conditions for perfect cooking, as I am convinced that defective stoves now in the market do us a serious injury, by keeping up the prejudices some of the public have against cooking by gas.

I know I shall surprise some by stating that I am not convinced of the advantage claimed by the use of the atmospheric burner, except for special purposes, for most of them in use certainly create more smell than a properly constructed burner with jets or fishtail burners arranged so that they do not touch the vessel being heated, and they are certainly not more economical.

Some years ago I made certain experiments with both these burners, for heating 60 gallons of water, and in both cases the same quantity of gas was consumed to raise it to boiling point. The atmospheric burner, however, had the advantage in point of time; and I am also of opinion that the burners made for gas stoves by Mr. Sharp in the earlier days of cooking by gas have seldom been equalled, and they certainly did not produce the smell and cause the complaints that we so frequently hear now arising from defective apparatus.

These statements are made from the results of personal observation and experience which commenced 29 years ago at Northampton, where the manufacture of cooking apparatus, which had been introduced about 12 years previously, was carried on in the ordinary way of business; and during the whole time since that period I have been connected with gas companies (previous to my appointment with the Corporation of Manchester), and it has happened that all have been manufacturers of gas apparatus. I have therefore seen gas applied, and have myself been able to apply it, for many purposes other than cooking. It is very valuable when used as a gas fire in offices and bedrooms where occasional heat is required, and especially in time of sickness, where an even temperature is desired; also for heating small conservatories. There are many other purposes to which gas can be adapted, and we are all very much indebted to Mr. T. Fletcher, of Warrington, who not only produces a cheerful gas fire for heating purposes, but also various gas furnaces and other appliances for use in the laboratory and workshop.

There is not much time for me to lay before you the merits of the various gas engines that are now being so extensively used. It was thought, when they were first introduced, that they would only be applied in exceptional cases and for small power. The "Otto" engines, however, are now being made by Messrs. Crossley Bros. up to 40-horse power. The consumption in these engines is stated to be 20 feet of gas per indicated horse power per hour. This statement I can confirm by independent testimony I obtained outside Manchester some time ago, which gave the following results with gas of 15-candle power:

No. 1.—3½-horse power "Otto" silent gas engine, used for driving two large lathes, planing machine, circular saw, and grindstone. Consumption of gas, 70 cubic feet per hour.

No. 2.—2-horse power "Otto" silent gas engine pumping 2,000 gallons of water 100 feet high per hour. Consumption of gas, 50 cubic feet per hour. Left without attention for hours.

No. 3.—3½-horse power "Otto" silent gas engine, with the latest improvements, in engineer's shop. Worked two lathes, one drilling machine, fan for blacksmith's forge, and grindstone. Consumption of gas, 55 cubic feet per hour.

These engines have now become severe competitors with steam engines, especially where intermittent work is required.

To increase the consumption of gas during the daytime, and more fully to utilize their plant, much has been done by corporations and gas companies by letting out on hire both heating and cooking stoves, of which some have several hundreds in use. If this could be carried out on an extensive scale in most places, it would ultimately tend to a reduction in the price of gas—a desideratum much wished for by all of us; for there is no doubt that the more cheaply gas can be supplied, the more generally will it be used.

I hope I have not taken up too much of your time; if so, it arises from a desire to touch upon most of the ways in which gas is applied, which, in themselves, form ample matter for separate papers.

In conclusion, I beg to say that if all its many advantages were more generally known to the public, they would avail themselves of them. I consider there is a wide field open to gas engineers, and those interested in the consumption of gas, for imparting information to the consumers and the public generally on this important subject.

The Deterioration of Gas Pipes.

By E. G. Love, Ph.D.

The natural process of "rusting" or oxidation of iron pipes is constantly engaging the attention of the gas and water engineer. This change of the metal to its oxide is gradually effected in the presence of oxygen and moisture; and, so far, no process has been generally recognized as both efficient and economical for preventing this deterioration. Coatings of paint, pitch, etc., have found a limited use, and answer very well for a time. Galvanizing has been tried, but it is expensive and not always desirable. The processes of Barff and Bower, for producing a coating of the magnetic oxide on the surface of the metal certainly promise well, but at present the expense attending such treatment prevents its application to any but smaller objects.

Besides the natural "rusting" to which all unprotected gas pipes are subject, occasional mention is made of pipes which in especially exposed places have been converted into a soft, graphitic substance, which, although retaining the form of the pipe, is easily broken and even cut with a knife. There are a number of cases on record of cast iron cannon balls in which, after many years of exposure to the action of sea water, not a trace of metallic iron was to be found. In some cases, the simple exposure of these balls to the air produced a chemical action so intense as to make them very hot, and after a short time they crumbled to powder. Cases such as these, however, are of unusurl occurrence, and are noticed only when the iron has remained for a long period of years subject to the influence of salt water without the contact of the air.

The change of gas and water pipes into this graphitic condition is of more common occurrence. While there is a general uniformity with regard to the cause which produced the change, the nature of the products greatly varies, and this is especially noticeable in the case of the iron itself, which, while there is no metallic iron remaining, may have been converted into the ferrous oxide, the ferric oxide or magnetic oxide. Mr. K. Birnbaum, in *Dingler's Poly. Journal* for 1879, gives the results of his examination of a specimen of gas pipe which had been in use for ten years near Saarbrücken. The substance was of a graphitic nature, could be readily cut with a knife, and presented a shining surface, which, however, disappeared after a few weeks' exposure to the air. The system of pipes, in the locality from which the specimen was taken, had been placed originally in trenches cut in a soft sandstone and surrounded with the refuse from locomotive fuel. Moreover, the pipes were more or less exposed to the action of water. All the pipe in this locality were found to have undergone the same change. After removing the adhering earthy matter, the substance had a specific gravity of 3.05. Its composition is shown in the following table, in addition to which an analysis of the earthy material is given:

	Material of the Pipes.	Earthy Matter.
Carbon	13.34	16.92
Silicic acid	15.34	23.30
Iron	52.18	.....
Ferric oxide	.....	46.73
Phosphoric acid	2.75	4.92
Sulphuric acid	1.35	3.22
Water	2.41	5.01
Oxygen	12.74	.....

The iron of the pipes was found to have been converted into ferrous and ferric oxide, and from the analysis, together with the supposed nature of the change, the author concludes that the iron of the original pipes had been converted into the magnetic oxide. The Saar coal contains considerable pyrites, and it is supposed that the sulphur compounds in the cinders,

acted upon by the air and water, gradually produced the change in the material of the pipes.

Mr. R. Cowper recently read a paper before the London Chemical Society in which he gave the results of his analysis of a piece of oxidized iron from the condenser of a steamship. The specimen was of a brownish color, "with many shining black particles, and resembled a piece of rusty gray pig-iron." Its specific gravity was 2.63. The analysis shows the presence of quite a variety of compounds. The principal of these are given in the table which follows, and in addition to those mentioned there were found in very small quantities copper, cobalt, alumina, magnesia, soda, vanadic acid and hydrogen. The large amount of ferrous oxide is quite remarkable. The iron formed part of a box through which ran a copper pipe, and it was suggested by Dr. Dupre, "that the rapid oxidation was caused by a galvanic action of the iron and copper, rather than by the rusting of iron in sea water." Others dissented from this opinion, however.

Some time ago the writer received from Mr. Thomas Turner, Engineer of the Charleston (S. C.) Gas Company, a specimen of iron which had undergone a change similar to those already mentioned. It was part of an iron plug taken from a gas pipe in that city, and it was understood that this deterioration had been noticed to a considerable extent. The specimen was of a brownish color, could be readily cut with a knife, and had a specific gravity of 213. The gas pipes in Charleston, as in most seaboard cities, are more or less exposed to the action of sea water, and the deleterious action of this substance upon cast iron is sufficiently well recognized to furnish an explanation in the present instance. Moreover, the process of oxidation appears to be more rapid when the iron is subjected alternately to the action of sea and fresh water.

The analysis of this specimen is given in the second column of the following table. Besides the constituents mentioned there were small quantities of magnesia, alkalies and chlorine, in addition to the water.

	Iron from Condenser of Steamship.	Iron Plug from gas pipe, Charleston.
Carbon	12.57	14.72
Silica	16.98	24.56
Ferric oxide	2.33	40.36
Ferrous oxide	42.33	.....
Manganic oxide	1.02	0.83
Lime	0.15	1.14
Phosphoric acid	5.24	3.89
Sulphuric acid	0.31	1.17
Chlorine	2.08	.....
Water	16.71	.....

The carbon existed as graphite, of which there was a considerable amount. No ferrous oxide was present. It should be mentioned, however, that the analysis was not made until some time after the removal of the plug from the pipe.

The pipes are, in some cases, covered with ashes and other refuse, and it is possible that the sulphur compounds may have had some influence in producing the change, although without doubt it could have been brought about by the action of the salt water alone.—*Sanitary Engineer.*

Why Caution Should be Exercised in Dealing with New Electric Light Companies.

The Continental Electric Light Company is an organization having an office in the Boreel Building. According to circulars issued by this company it possesses an electric lamp that will furnish its own electricity at a trifling cost, or no cost at all, and will be practically indestructible. The company's stock is placed at $20,000,000, in shares of $100 each. Very little attention has been paid to the company or its lamp until yesterday, when a report was received from Boston charging the Continental Company with an attempt to defraud some Bostonians of $30,000 by selling them rights in a worthless invention. Negotiations for the sale were broken off when a Bostonian who came here to investigate the standing of the company returned to Boston with unfavorable reports.

A reporter of the *Evening Post* called this morning at the office of the company and was told that the officers of the company had nothing to say, no lamp to exhibit, no desire for publicity of any kind.

"How about these Boston people who accuse you of swindling them?" asked the reporter.

"Oh, that is of no consequence. Some of these Boston sharks came here and tried to swindle us out of some contracts. We were as sharp as they were, and now they are 'squealing' with disappointed rage."

From inquiries made among officers of the reputable electric light companies of the city it was ascertained that no doubt was entertained as to the Continental Company's ability to meet sharpers from Boston or anywhere else. The President of one of the best known companies said that the mania among stock operators for getting up electric light companies, with a view to beguiling unsuspecting investors, who are attracted by the enormous dividends promised, and the cheapness of the stock. Gorgeously engraved $100 stock certificates, done in four or five colors, entitling the bearer to all sorts of good things, can be manufactured for ten or fifteen cents apiece, and it may be possible to find buyers for them at, say, $2 50 apiece if enough ingenious stories are told about the millions to be made by investing a few dollars in them. Allowing a liberal estimate for the expense of engraving the certificates, hiring an office, and paying a few respectable looking old figureheads to sit at big desks and look as wise as owls, you see that there is a liberal margin for profit. I do not mean, of course, that the Continental Company is of this class, and I merely give you this illustration to show how money can be made by getting up an electric light company.

"Some months ago I received a letter from a Wall street speculator offering me entire control of a new electric light company to be formed with a capital of $20,000,000. All these companies deal with millions as readily as with thousands. The proposed company, the letter said, had bought valuable patents covering the most complete system of electric lighting yet devised. They had a new dynamo, new incandescent lamps, new systems of dividing the current, a new system of transmitting the electricity, and, in fact, everything was new, and covered by patents which infringed on no other patents. They proposed to give me one million dollars worth of stock if I would become President of the company. The letter puzzled me, and to satisfy my own curiosity I engaged some detectives to look into the matter. I found that the proposed company consisted of several Wall street speculators who know no more about electric light than about astronomy. In order to get a basis for their operations they made a contract with an engineer, who was not even an electrical expert, to furnish a newly-invented system of electric lighting, in which every point should be covered by patents not conflicting with any others. So far as I could discover, the engineer in question had never invented anything connected with electric lighting, never has any intention of doing so, and was never expected to do so by the man who paid him for the use of his name. All that was required of him was to talk mysteriously of his inventions, and sign his name to circulars.

"As to this wonderful lamp, said to be the property of the Continental Company—a sort of combination of the Keely Motor and an indestructible fiber—I never saw it or heard of any reputable person who has. It is said to be a portable lamp. In this connection it occurs to me that about a year ago an officer of high rank in the British Army passed through this city, on his way home from Australia, where he had been on some Government mission. While here he was much interested in our electric lights, and told several gentlemen connected with the leading companies that while in Australia he had seen a portable lamp in which the current was produced by chemicals in the base of the lamp. The apparatus was too heavy for practical use, but contained, he thought, the germ of a future portable lamp. It may be something of this kind that the Continental Company has got hold of, but in that case the talk about producing the electricity without cost is ridiculous, for zinc costs money.

"There seems to be an idea in the public mind at present that, as the electric light is to be the light of the future, it would be well to have a finger in the pie, consequently no scheme connected with electric lighting is too absurd to find support from foolish investors. A patent was applied for on January 10, 1881, by Elizabeth Morey, who had invented a portable lamp which was to get light from the current furnished by a miniature dynamo worked by a clock spring. Such a power would not furnish current enough to scare a cockroach, to say nothing of producing light."—*Evening Post*, May 1.

Piping Gas from the Coal Mines to the Cities.

The company recently organized to utilize the waste gas of the coke country, it is stated, are simply carrying out a suggestion made by Dr. Siemens in a long essay published years ago. His plan went even further. He advocated as a practical, economical measure, the building of gas works at the foot of every saft in the "Black Country" of England. The waste coal was to be used in making gas, which was then to be conducted in pipes to the city of London.

His object in making the gas underground was two fold. The cost of hoisting the crude coal to the surface would be saved—no small item when the great depth of the mines in England is remembered. Besides, he had an ingenious arrangement by which a constant current of fresh air was to be kept up in the mine. The strong pressure from so great a depth would also carry the gas to London without the use of pumps. He counted the saving in coal by the consumption of slack, which would otherwise be thrown away, the difference in the cost of transporting gas through a pipe, and coal by rail, the economy of labor in doing away with the work of loading on the cars, unloading again in the city, hauling to the different houses,

unloading, shoveling into buckets, carrying up long flights of stairs, and putting it in the grate or in the stove—for he looked ahead of his generation to the day when gas should be universally used for heating as well as for light. He even calculated the number of steps in all the stairs of London, and reckoned in his calculation the wear and tear of carpets by the feet of those who carried in the coal and took away the ashes. Even the cost of removing the ashes from the city was not forgotten.

After a deal of figuring he arrived at the conclusion that by his plan the city of London could be lighted and heated at one-tenth the cost of the present method. His premises were taken with great care, and his deductions logically drawn; but, despite his high reputation, the scheme was so revolutionary that no British capitalists were ready to put their money in an experiment so costly. Perhaps the wail of statisticians over the nearly prospective exhaustion of the English coal fields will stir them up to try it, but much more likely they will wait and watch the experiment in this country, though the success of the oil pipe lines should give them courage.—"St. Geo.," in *Am. Manufacturer*.

Report and Accounts of the Paris Gas Company for 1881.

The report and accounts of the Paris Gas Company for the year ending December 31, 1881, which were presented at the annual general meeting of shareholders held on March 24, are of the customary voluminous character, and furnish full particulars as to the Company's operations during the period over which the report extends. The various matters dealt with are, as usual, grouped under different general headings, and this arrangement will, as in previous years, be adhered to in the following reproduction of the report:

GENERAL REVIEW OF THE COMPANY'S OPERATIONS.

Consumption of Gas.—During the year 1881 the Company sent out from their works 260,926,769 cubic meters (9,210,715,000 cubic feet of gas), being 16,581,445 cubic meters (585,324,000 cubic feet) more than in 1880. The day consumption of gas—namely, that which takes place between the time of extinction of the public lamps and that of their relighting—figures to the extent of 67,168,415 cubic meters (2,371,045,000 cubic feet), or about 25 per cent. in the total consumption. This day consumption arises principally from the use of gas for industrial and domestic purposes, the varied requirements of which increase daily, and offer an ever extending field for the Company's operations.

Receipts for Gas.—The receipts from the sale of gas, which in 1880 were 61,030,715 frs. ($12,215,000) in 1881 reached the sum of 66,471,191 frs. ($13,294,000). These receipts may be apportioned as follows between the two great divisions of the Company's area of supply:

In Paris proper.....	61,804,851 frs.	$12,360,970
In the outskirts	4,666,340 frs.	933,268
Total.....	66,471,191 frs.	$13,294,248

Consumers.—The number of consumers on Dec. 31, 1881, was 159,239; exceeding by 11,025 the number at the corresponding date in 1880. This is the first time in the history of the Company that so large an increase has taken place in a single year in the number of consumers. Of these 11,025 new consumers, about three-fifths are supplied from the "house services."*

Public Lighting.—The number of public lamps in use on the 31st of December last was—

In Paris proper.....	44,230
In the outskirts	7,561
Total.....	51,791

—exceeding by 2647 the number in use on Dec. 31, 1880. Of thes 51,791 lamps employed in the lighting of the public thoroughfares, 315 are of the pattern of those fixed in the Rue du Quatre Septembre, which consume 1,400 liters (50 cubic feet) per hour; and 249 are similar to those in the Place de la Republique, which consume 876 liters (30.8 cubic feet) per hour. Most of these large high-power burners and lanterns are placed on refuges in the principal streets, or at the junctions of the more frequented thoroughfares, and contribute very considerably to the safety of both vehicular and pedestrian traffic. Burners of this type, to the number of 965, have also been fitted up by private persons at the entrances to cafes, theaters, warehouses, and similar establishments. The total number of high-power burners in use in Paris, for public and private purposes, is 1,529; representing about 8,600 of the ordinary 5 feet burners.

House Services.—The number of these services laid on at Dec. 31, 1881, was 15,773, distributed over 12,894 houses; being 1,358 more than the number at the corresponding date in the preceding year. Of these 1,358 new services, 485 were fixed upon the application of landlords, and 873 at the request of the occupiers of apartments. The whole of the house services, exclusive of the branch-pipes, fittings, meters, etc.,—for which a separate charge is made—have cost the Company 9,712,418 frs. ($1,942,484), or at the rate of about 616 frs. ($123) per service.

The receipts arising from the sale of gas consumed by means of these services in the past year amounted to 10,988,560 frs., showing an increase of 1,562,669 frs., or 16.5 per cent., on the analogous receipts in the preceding year, the amount of which was 9,425,891 frs. The number of consumers supplied from these services had on the 31st of December last reached 52,221; being 32.7 per cent. of the total number. This is a striking proof of the important part which the house services, and consequently the lighting of the upper floors of buildings, play in the development of the consumption of gas; and the Directors intend using all their efforts to extend this portion of their business as much as possible, with the view of making these services more productive than at present.

Principal Results of Working.—During the 26 years over which the Company's operations have extended—viz., from 1855 to 1881—the consumption of gas, which in the former year was only 40,774,400 cubic meters 1,439¼ million cubic feet), has increased more than sixfold; while the average annual increase, far from diminishing, shows on the contrary a tendency to advance considerably. In the seven years from 1874 to 1881 the consumption increased to as great an extent as during the 17 preceding years; while the average increase in the two years 1880 and 1881 exceeded by more than 80 per cent. that of the five antecedent years.

Manufacturing Power.—The annual manufacturing power of the Company's works, which on Dec. 31, 1880, stood at 261 million cubic meters (9,213½ million cubic feet), inclusive of reserve plant, was raised during last year to 282,310,000 cubic meters (9,965½ million cubic feet), in view of an increase in consumption equal to that of the preceding year. The Directors estimate that at the close of the current year, when the alterations now being carried on at the various stations are completed, the manufacturing power of the plant will reach 312 million cubic meters (11,013½ million cubic feet), which will enable them without difficulty to meet all the requirements of the service for next winter.

Canalization.—During the past year the total length of mains was increased by 50,841 meters, apportioned as follows:

	Meters.	Yards.
In Paris proper.....	27,649	30,229
In the outskirts.....	23,192	25,357
Total.....	50,841	55,586

The total length of mains laid under the public thoroughfares has therefore been increased to 1,915,049 meters, apportioned as follows:

	Meters.	Yards.
In Paris proper.....	1,331,637	1,455,923
In the outskirts	583,412	637,864
Total.....	1,915,049	2,093,787

—Abstract from *Journal of Gas Lighting*.

* These are the pipes carried up buildings for the supply of flats and separate apartments.

The Thames Embankment.

Londoners have recently had their attention rather rudely attracted to the Thames Embankment, and not a small section of the community has learned with dismay that a thoroughfare brilliantly illuminated with the electric light has as much cause to be dreaded after certain hours at night as was ever Hounslow-Heath or Crackscull-common in the days of Tony Lumpkin. The theories of the moral influence that the electric light was to exercise on society, driving crime before it like the criminal who flies before the Nemesis of Justice in Prud'hon's famous picture, would seem to have received a shock when murder is committed under the all-searching eye of the Brush system. But the fault lies not with the electric light. We are not prepared to enter into the social bearings of the question, with its sad proof of the moral depravity of certain sections of the dependent classes in our great city, the existence of which we ascertained when probing the back slums of London at a time when the fact was scarcely believed in. To blame the police is not within our province, but must it not appear to every one familiar with the Embankment that perhaps the chief cause of the terrible stories that have lately been brought before the attention of the Home Secretary consists in the loneliness and desertion that reign after dark along the broad thoroughfare which stretches its length from Blackfriars Bridge to the Houses of Parliament?

We do not speak of the even more lonely and scarcely less suspicious Albert Embankment on the other side of the water, and, again on the northern side, the Chelsea Embankment.—London *Builder*.

ONE RESULT OF A FOG.—The *Evening Post* says that a single day's fog in London recently brough $60,000 into the pockets of a single gas company.

THE AMERICAN
GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.
Manager—C. E. SANDERSON.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

TUESDAY, MAY 16, 1882.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
34 PINE STREET, NEW YORK CITY.

MAY 16, 1882.

☞ All communications will receive particular attention ☜ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid.	Asked
Gas Co.'s of N. Y. City.				
Central	$466,000	50	70	75
Harlem	1,800,000	50	94	96
" Bonds	170,000			103
Manhattan	4,000,000	50	223	227x
Metropolitan	2,500,000	100	167	170
" Bonds	658,000	..	107	110
Mutual	5,000,000	100	96	98
" Bonds, go'd.	900,000	1000	202	205x
Municipal	1,500,000	100	180	196x
" Bonds	750,000		106	110
New York	4,000,000	100	120	122
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	100	103
Citizens	1,200,000	20	63	67
" S. F. Bonds.	320,000	1000	105	109
Fulton Municipal	3,600,000	100	90	55
Peoples	1,000,000	10	40	—
" Bonds	290,000	.	104	107
" "	250,000	...	90	92
Metropolitan	1,000,000	100	50	55
Nassau	1,000,000	25	50	55
" Ctfs.	700,000	1000	93	96
Williamsburgh	1,000,000	50	50	60
" Bonds	1,000,000	...	100	101
Richmond Co., S. I.	300,000	50	70	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	—	75
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	—	—
" " Bds.	124,000	—	10	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			38	39
Bonds			107	—
East Boston, Mass	220,000	25	122	128
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	750,000	40	117½	
Jersey City	750,000	20	155	160
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo.	1,200,000	100	112	117
Montreal, Canada	2,000,000	100	173	174
New Haven, Conn		25	132	—
Oakland, Cal			32	33
Peoples, Jersey City		...	75	80
" " Bds.				5
Pittsfield, Mass			120	130
Rochester, N. Y		50	70	80
Wilmington, Del		50	174	...
Yonkers		50	30	32
St. Louis Missouri	600,000	50	250	254
San Francisco Gas-Co., S. Fr'isco Cal.			68	69
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C	1,500,000	20	185	200
" Scrip	375,000	15	200	206

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N. LEVASSEUR, Inspector."

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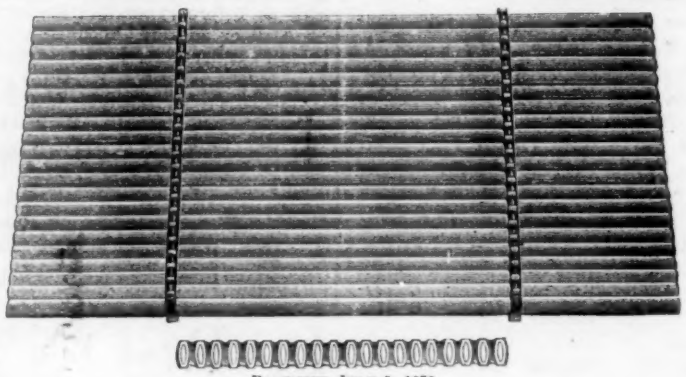

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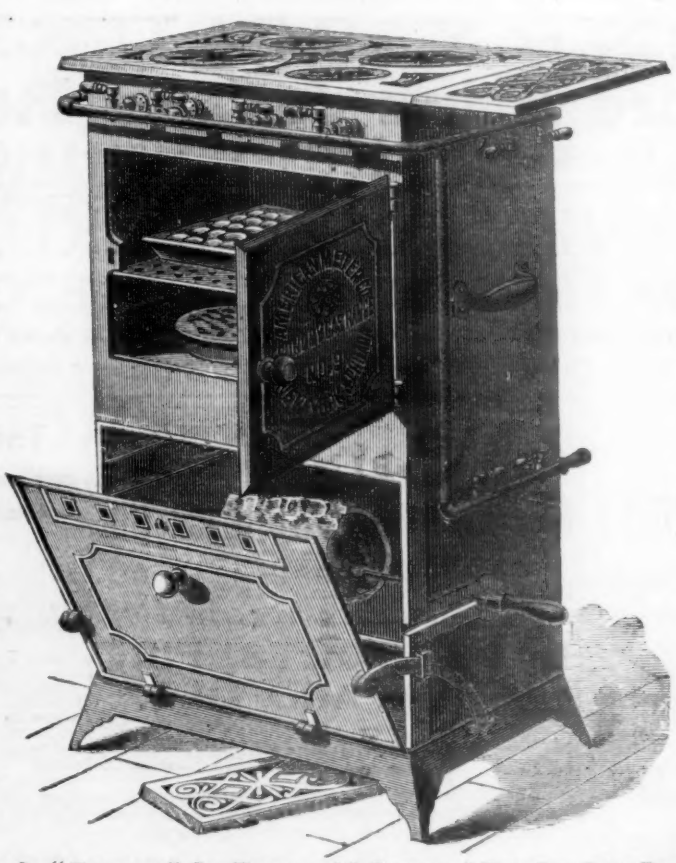

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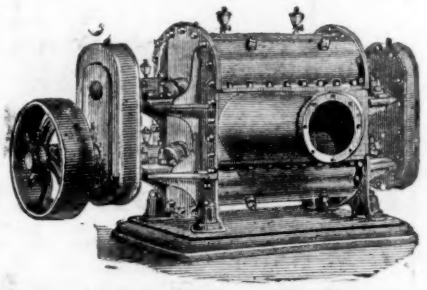

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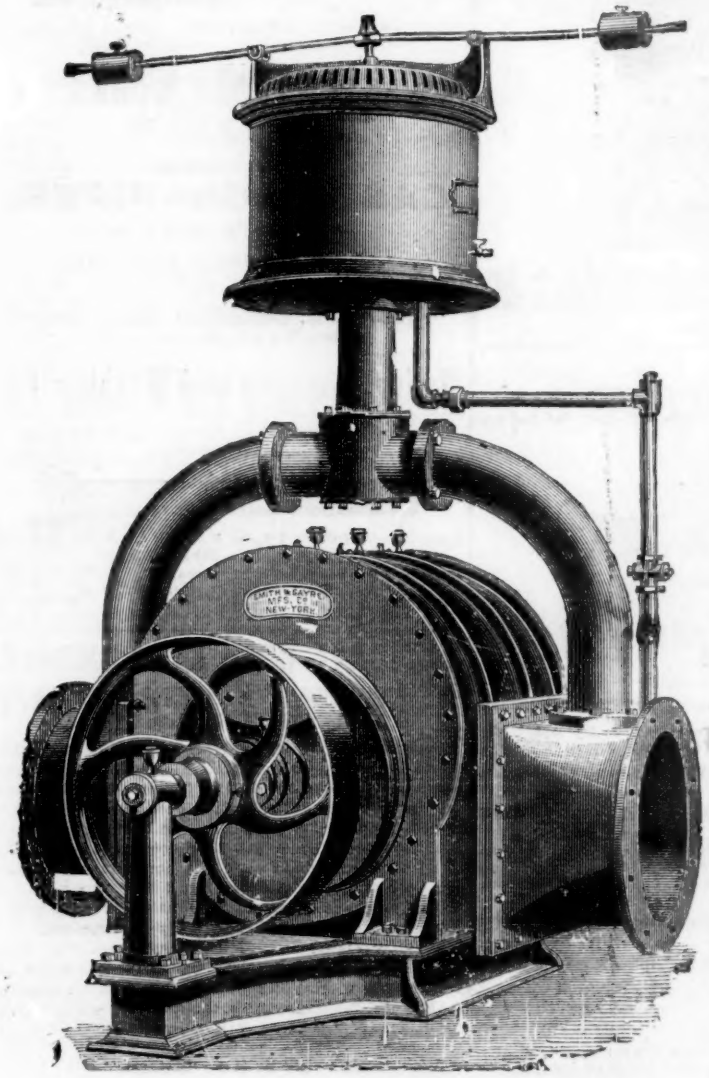

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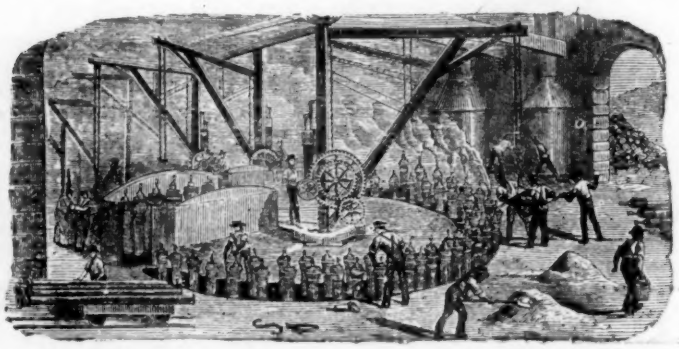

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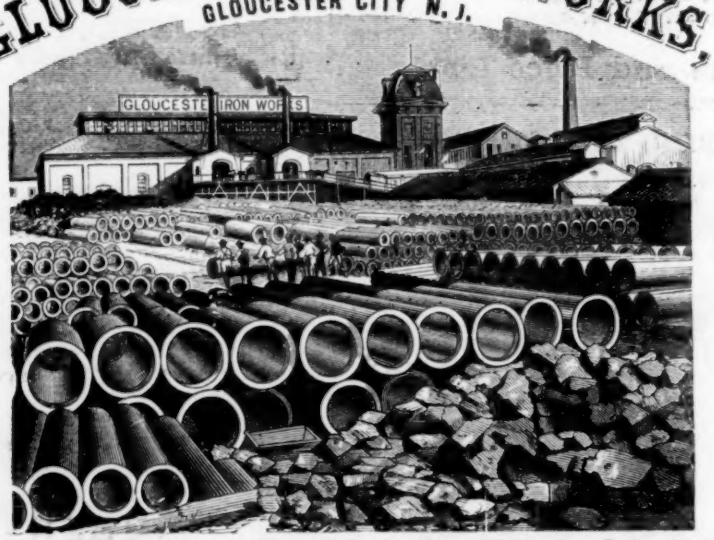

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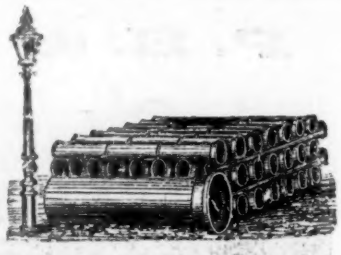

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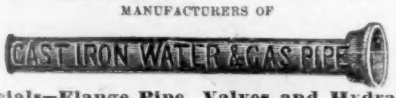

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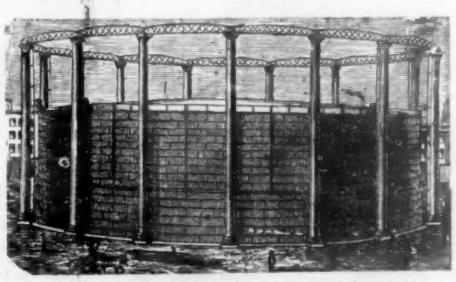

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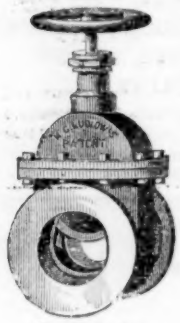

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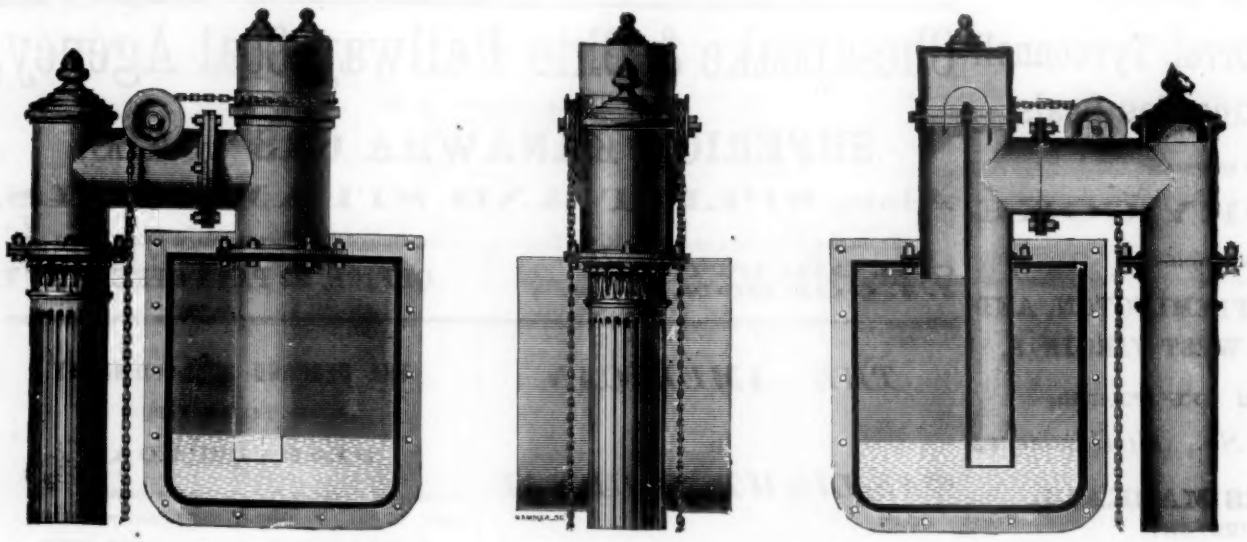

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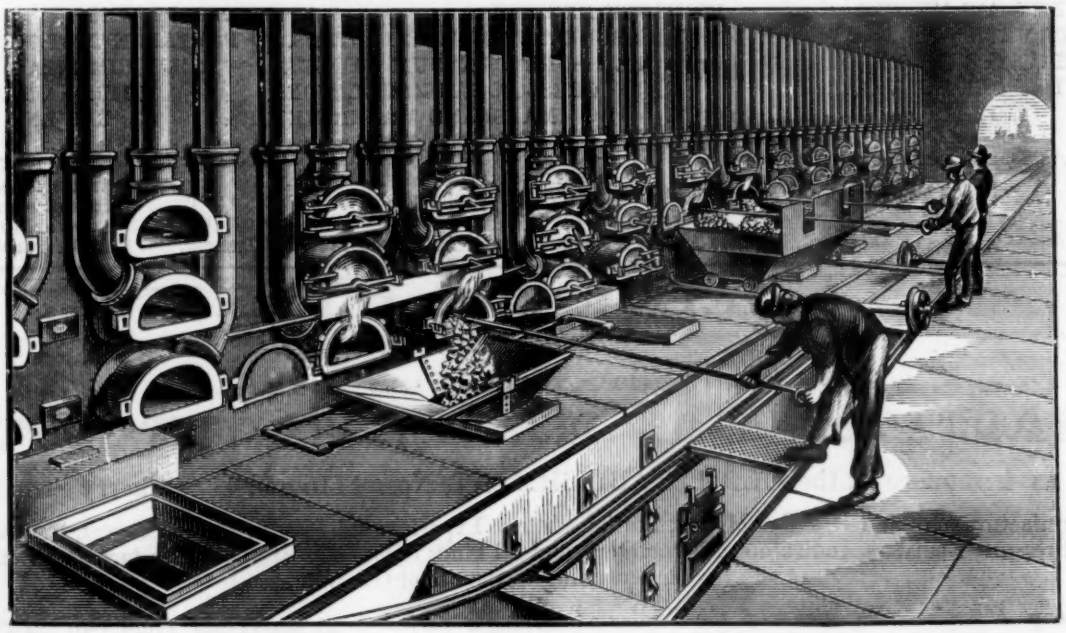

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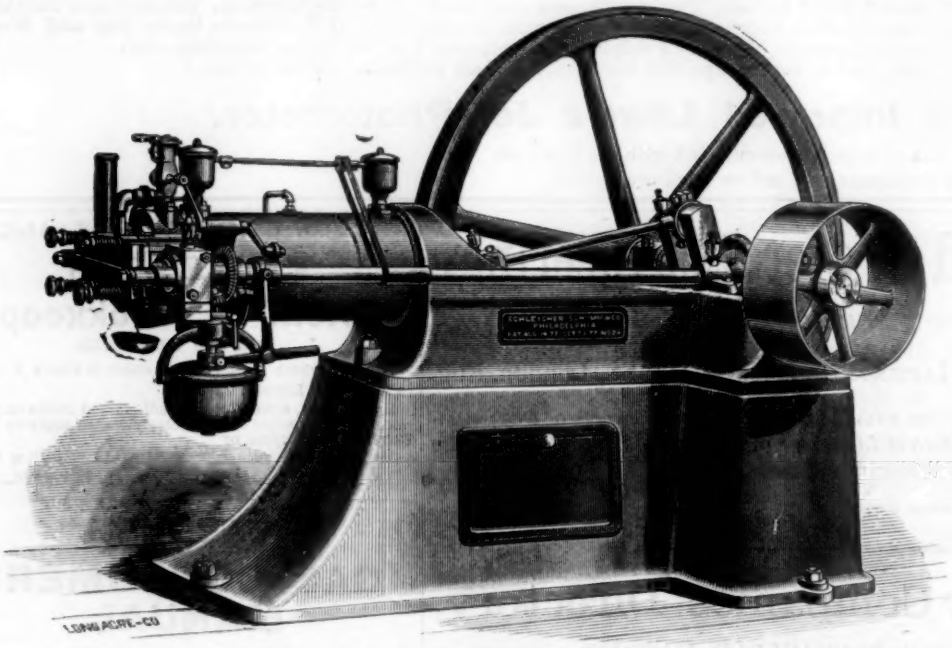

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